(Model.) 3 Sheets—Sheet 1.

J. A. DAVIS.

SEWING MACHINE.

No. 251,195. Patented Dec. 20, 1881.

FIG. 1.

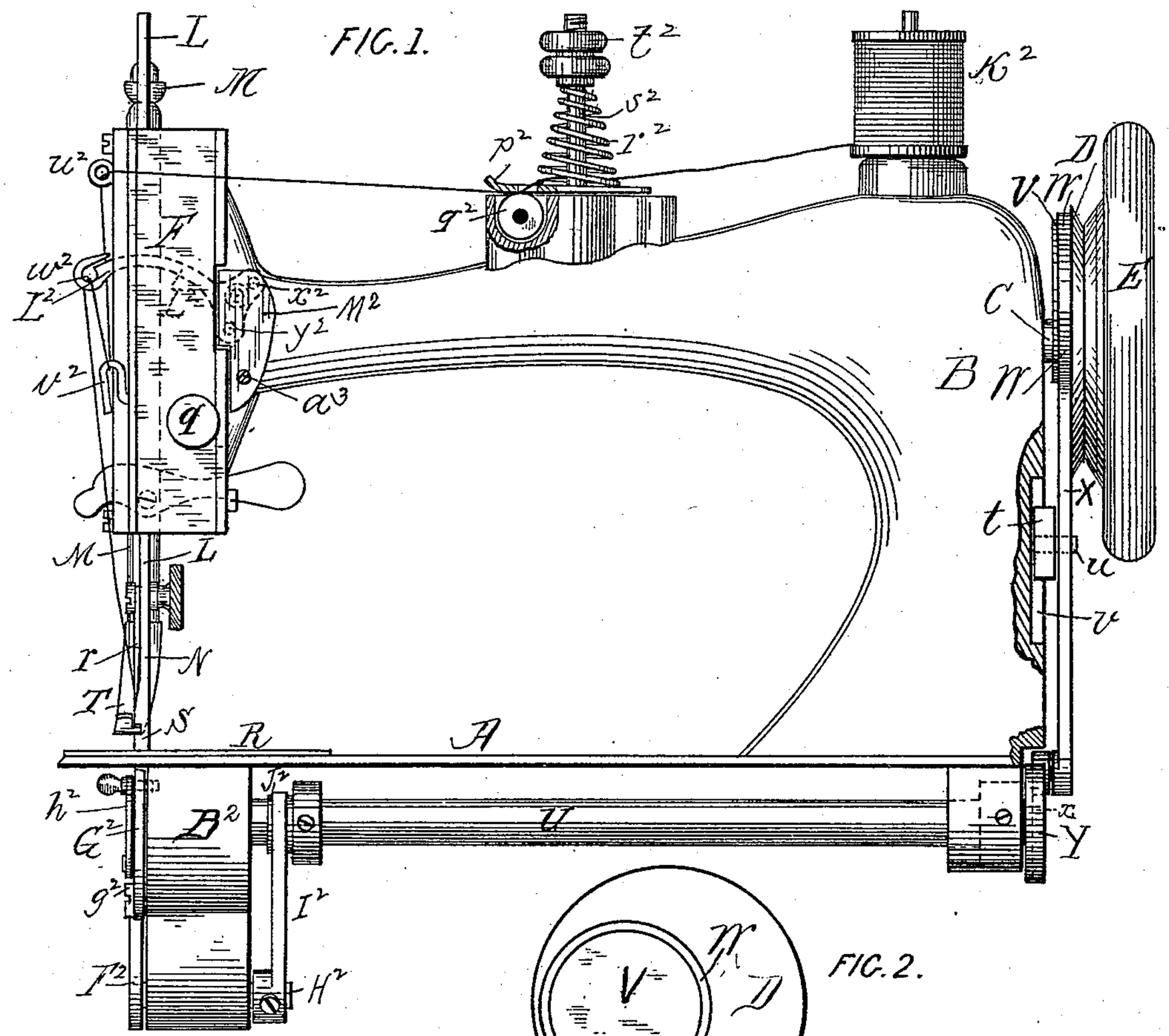


FIG. 2.

FIG. 3.

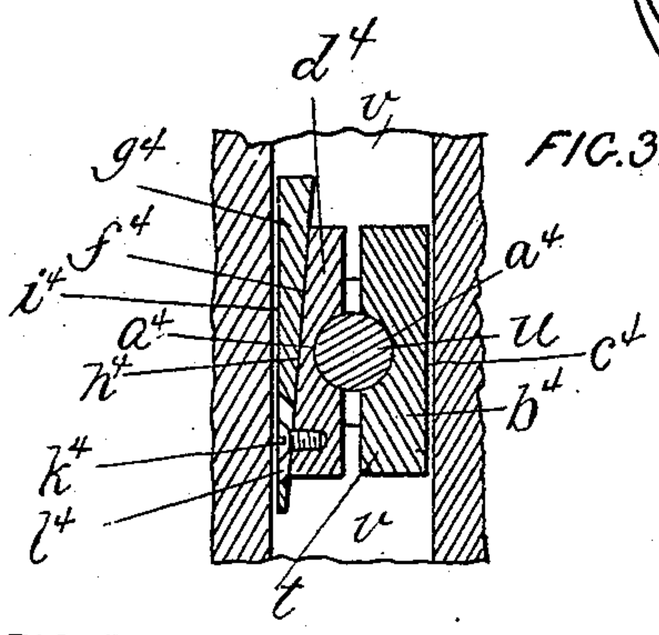


FIG. 4.

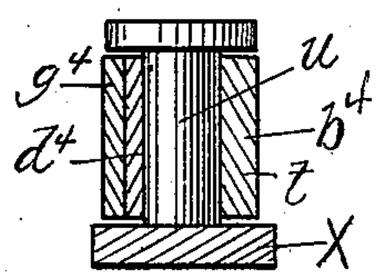
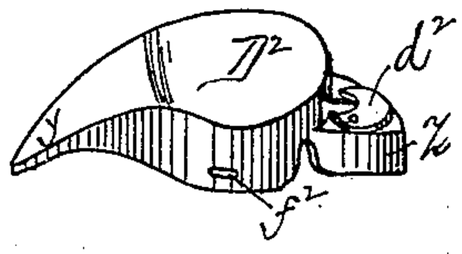


FIG. 5.



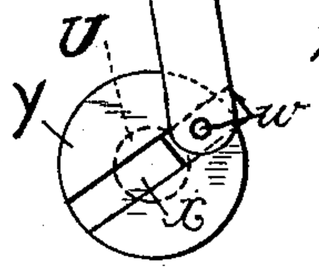


FIG. 6.

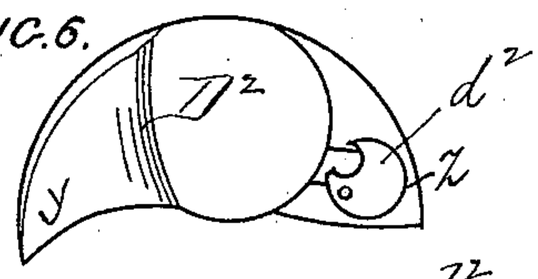


FIG. 8.

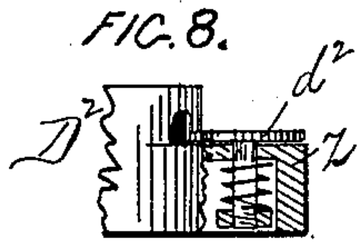


FIG. 7.

Witnesses.

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(Model.) 3 Sheets—Sheet 2.

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SEWING MACHINE.

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FIG. 9.

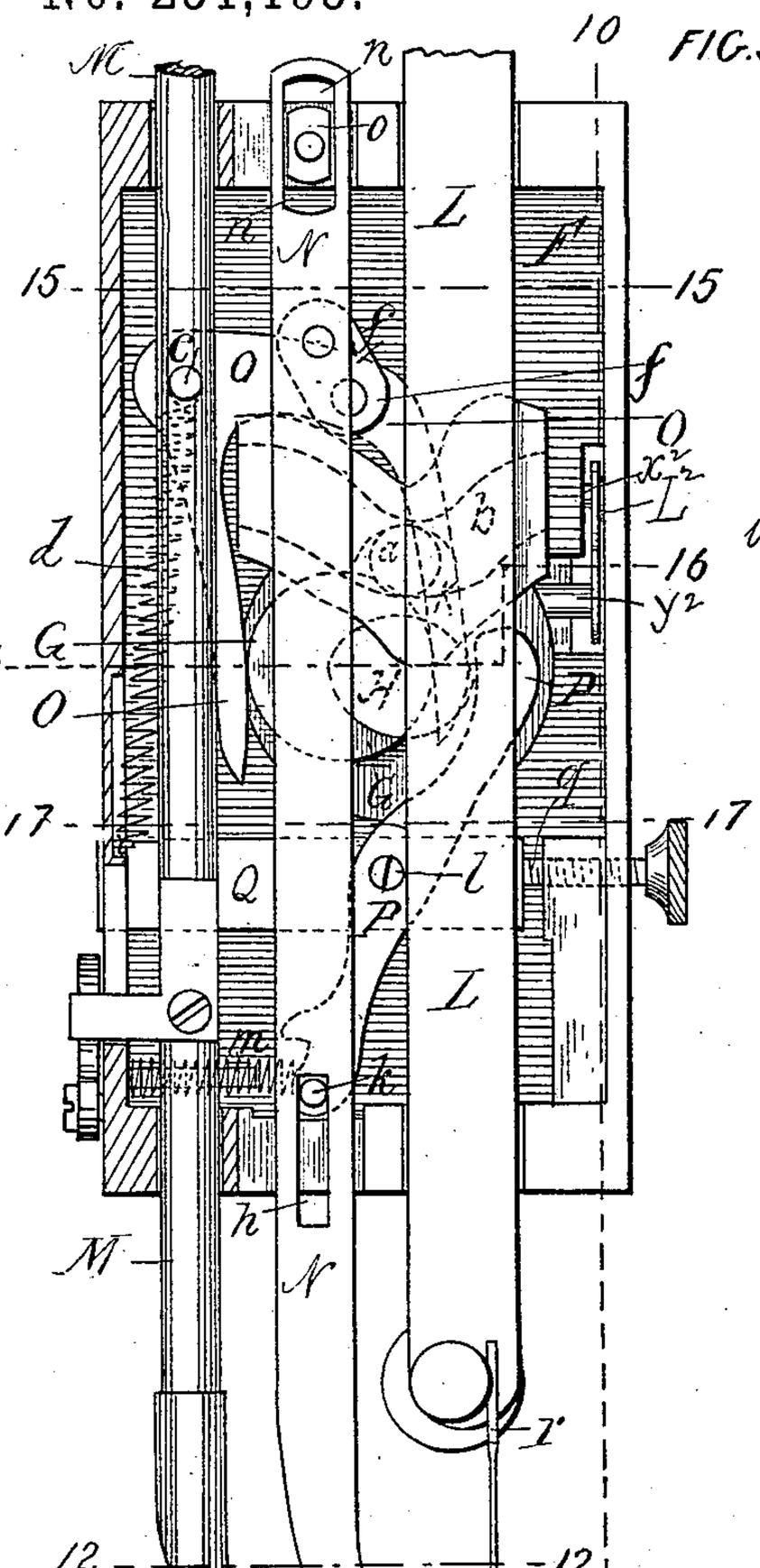


FIG. 10.

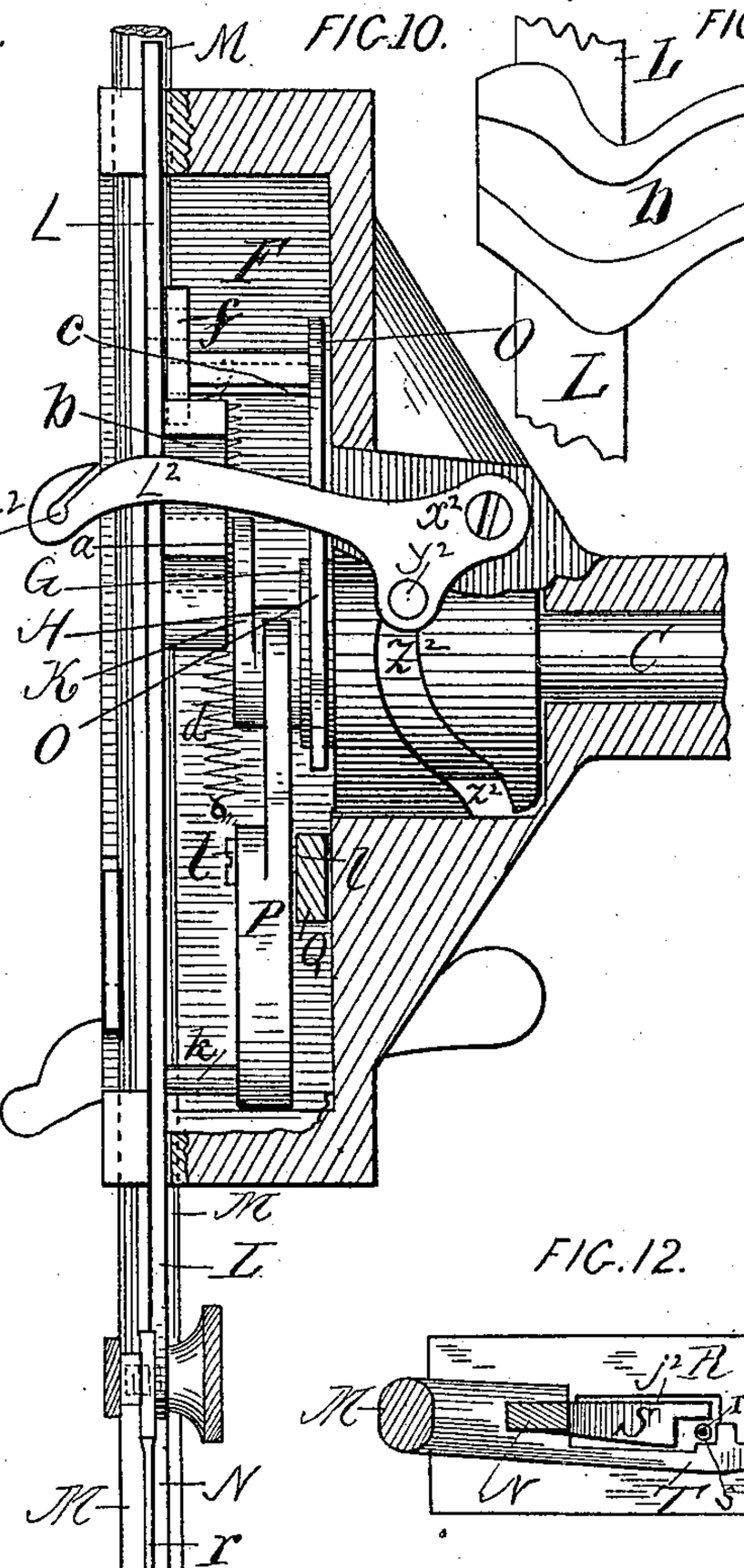
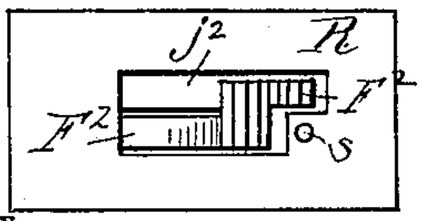


FIG. 11.

FIG. 12.

FIG. 13.



Witnesses.

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(Model.) 3 Sheets—Sheet 3.

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SEWING MACHINE.

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FIG. 14.

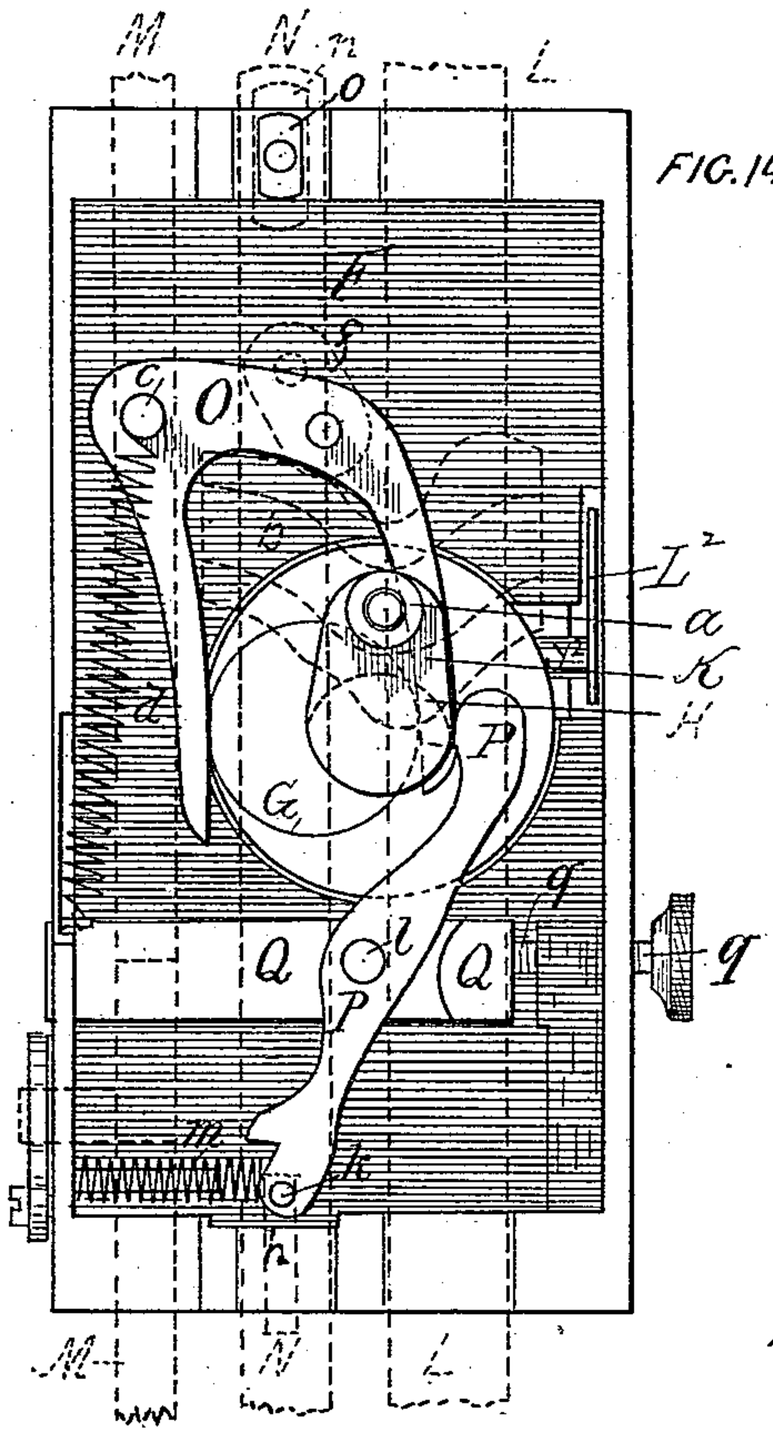


FIG. 15.

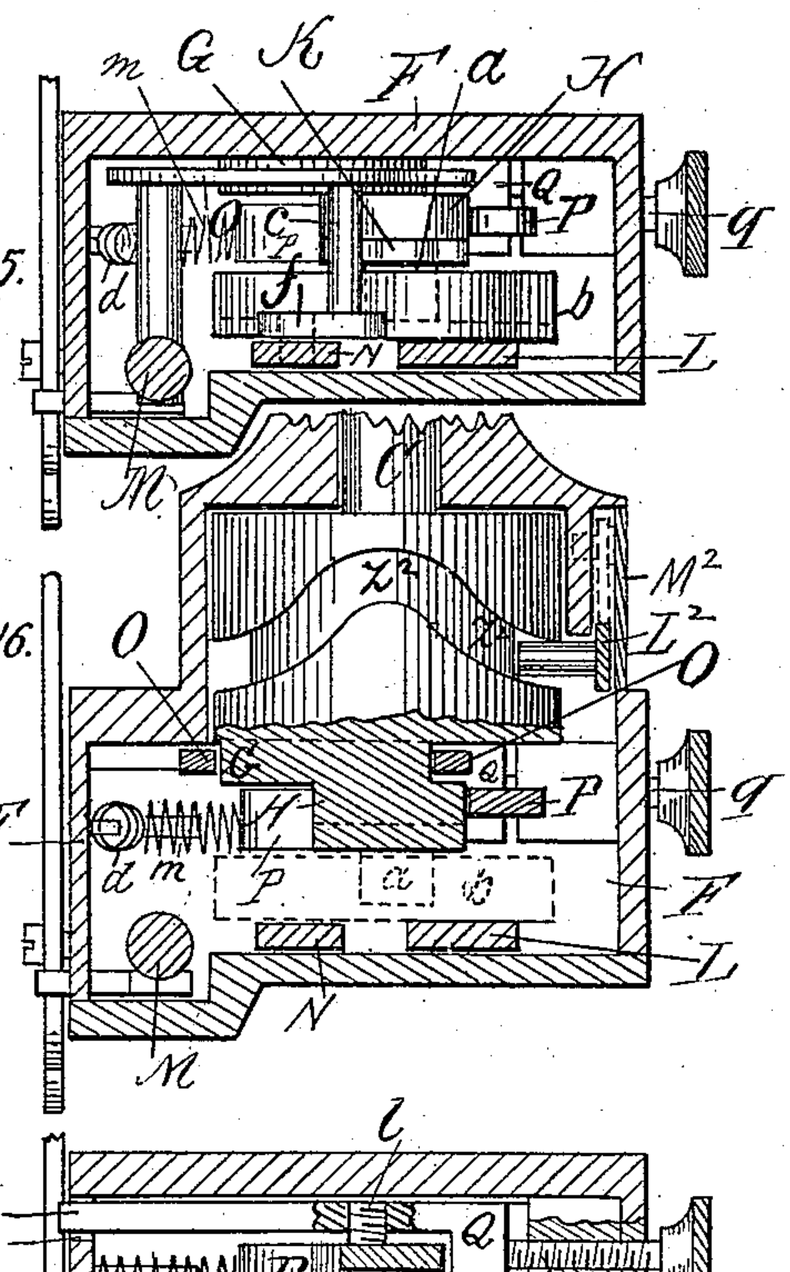


FIG. 16.

FIG. 17.

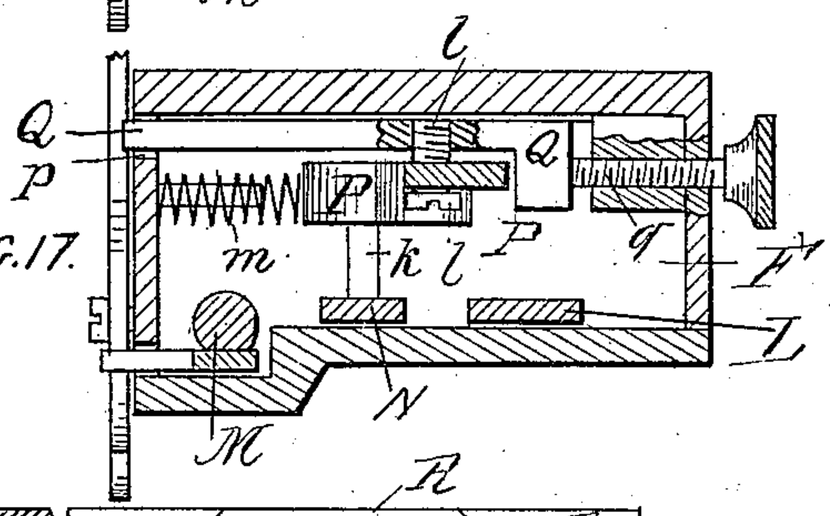


FIG. 19.

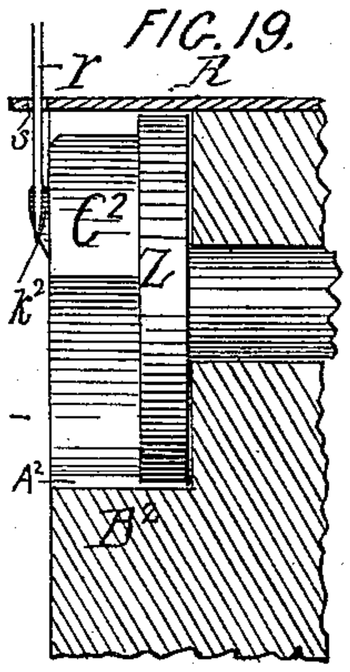
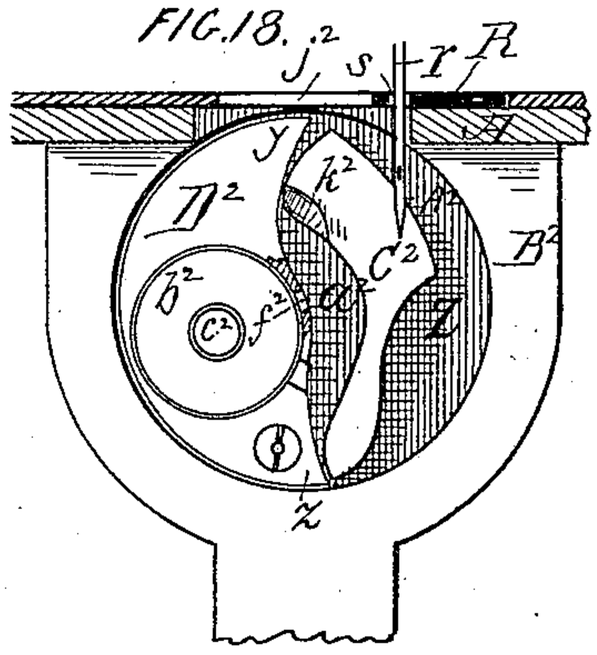


FIG. 18.



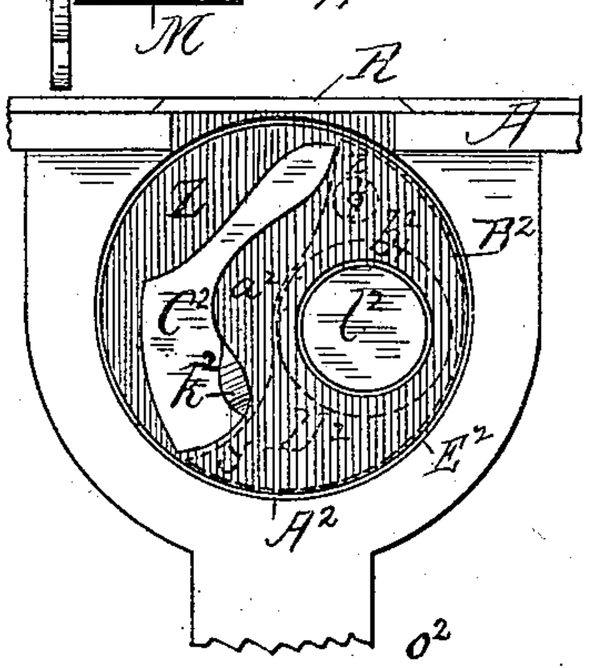
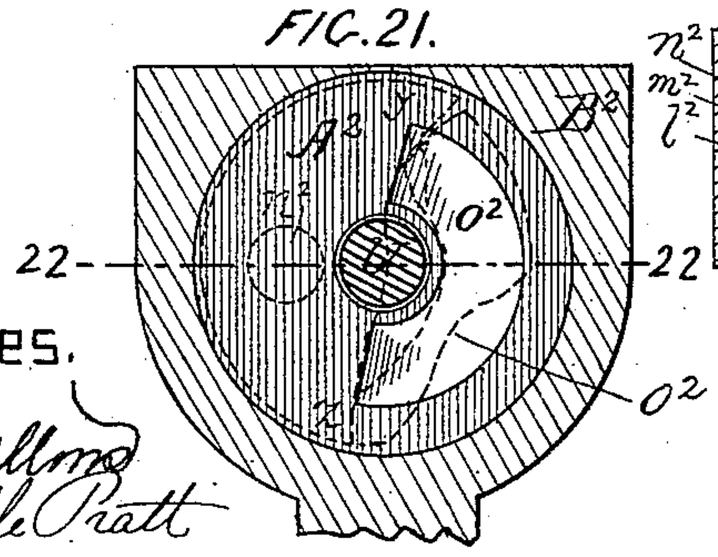


FIG. 20.

FIG. 21.



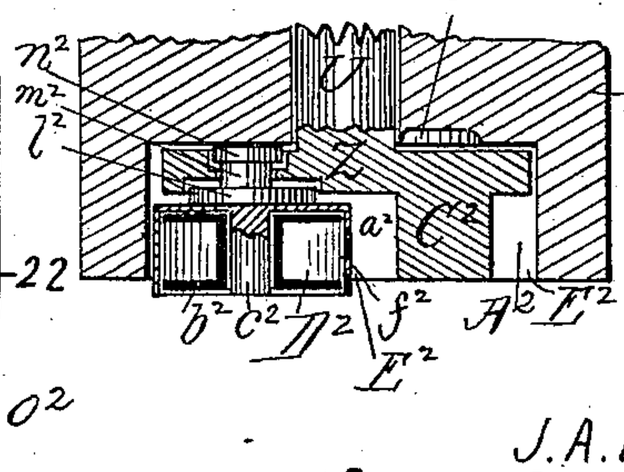


FIG. 22.

Witnesses.

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Attorneys.

UNITED STATES PATENT OFFICE.

JOB A. DAVIS, OF BOSTON, ASSIGNOR TO WILLIAM T. COOK, OF FOXBOROUGH, MASSACHUSETTS.

SEWING-MACHINE.

SPECIFICATION forming part of Letters Patent No. 251,195, dated December 20, 1881.

Application filed February 1, 1881. (Model.)

To all whom it may concern:

Be it known that I, JOB A. DAVIS, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Sewing-Machines, of which the following is a full, clear, and exact description.

This invention relates more particularly to that class of sewing-machines employing a continuous rotating shuttle or under-thread carrier and a rectilinear reciprocating eye-pointed needle or upper-thread carrier; but some parts of it, as will be obvious from the description hereinafter given, are applicable as well to other classes of sewing-machines.

This invention consists, first, of mechanism for operating the feed; second, of mechanism for operating the needle-bar, the feed-bar, and the presser-foot; third, of mechanism for driving a continuous rotary shuttle, whereby it is made to move at a speed greater at one part of its travel than at the remaining part; fourth, of a continuous rotary shuttle having an elongated eye; fifth, of a device for deflecting the needle-thread from the path of the shuttle; sixth, of mechanism for confining and releasing a continuous rotating shuttle in a direction at right angles to its path of rotation; seventh, of an upper and lower feed-bar, arranged, the lower feed-bar to work in one direction from and with the upper feed bar and in the other direction independently of such upper feed-bar and by mechanism of its own; eighth, of a rotary shuttle-carrier constructed to place and keep the needle in its proper line of movement; and, ninth, of a construction of the raceway for a rotary shuttle-carrier and its shuttle, all substantially as hereinafter described.

In the accompanying plates of drawings this invention is illustrated.

In Sheet 1, Figure 1 is an elevation of the front side of the machine; Fig. 2, a detail view of the connecting mechanism between the upper and driving shaft and the shaft driving the rotary shuttle; Figs. 3 and 4, enlarged vertical and horizontal sectional detail views, respectively, of a portion of Fig. 2. Fig. 5 is a perspective view, Fig. 6 a rear view, Fig. 7 a side view, and Fig. 8 a detail sectional view, of the shuttle.

In Sheet 2, Fig. 9 is an elevation of the needle, presser, and upper and lower feed bars, and of their operative mechanism; Figs. 10 and 12, vertical and horizontal sections, respectively on lines 10 10 and 12 12, Fig. 9; Fig. 11, a detail view of the cam-groove on back of the needle-bar; Fig. 13, a plan view of the needle throat plate, and opening in the cloth-plate for lower or auxiliary feed-bar.

In Sheet 3, Fig. 14 is an elevation similar to Fig. 9, Sheet 2, above the bed-plate, with the needle, presser, and feed bars removed, their positions being indicated by dotted lines; Figs. 15, 16, and 17, horizontal sections on lines 15 15, 16 16, and 17 17, respectively, of Fig. 9, Sheet 2; Fig. 18, an elevation of the open end of the shuttle-race with the under feed-bar removed; Fig. 19, an edge view of Fig. 18, showing the shuttle-carrier and needle; Fig. 20, an elevation of the shuttle-carrier with the shuttle removed; Fig. 21, an elevation of the shuttle-race back of the shuttle-carrier; Fig. 22, a horizontal cross-section on line 22 22, Fig. 21, showing, also in section, the shuttle-carrier and shuttle.

In the drawings, A represents the bed-plate of a sewing-machine, having a goose-neck standard, B, which is the support for a horizontal driving-shaft, C, having at one end a grooved driving-pulley wheel, D, and a balance-wheel, E. This driving-shaft C terminates in a chambered head, F, of the standard B, and therein it is provided with two separate peripheral cams, G H, and a crank-arm, K, having a friction-roll, *a*, each in a separate and distinct vertical plane.

L is a needle-bar, M a presser-bar, and N an upper feed-bar. These several bars are located at the chambered head F of the standard B, and they are there arranged side by side, with the feed-bar between the needle and presser bars, each to be moved separately and independently of the others and in a vertical plane at right angles to the bed-plate. The needle-bar L carries a plate having a cam-groove, *b*, which sets over the friction-roll *a* of the crank-arm K, and thus the needle-bar is moved up and down as the driving-shaft rotates, said needle-bar being guided in such movement by suitable guideways of the walls of the chambered head F.

The presser-bar M is pivoted at *c* to a U-

shaped frame or tumbler, O, which straddles and bears against the two opposite sides of the periphery of the cam G, and under the revolution of this cam, operating on one of the legs of the tumbler O, the presser-bar is raised, and by the cam acting on the other leg of the tumbler the presser-bar is moved in the opposite or downward direction, and both of such movements are in suitable guideways in the walls of the chambered head. A spiral spring, *d*, acts to hold the presser-bar to the goods being sewed, in the usual manner.

The feed-bar N has a link, *f*, which at one end is pivoted to it and at the other end to the tumbler O, and it has a slot, *h*, running in the direction of its length, which slot sets over a stud, *k*, carried by a lever-arm, P, that turns upon a fulcrum-pin, *l*, of a horizontal slide-bar, Q, and bears against the periphery of the cam H, a spring, *m*, suitably applied to the lever P, holding it to such bearing. The upper part of the feed-bar N has a slot, *n*, along its length, and by this slot it slides over a guide-block, *o*, pivoted to a wall of the chambered head F. The rotation of the cams G H—the one, G, through the tumbler O and the other, H, through the lever-arm P—gives respectively an up-and-down movement and a forward-and-backward horizontal movement to the feed-bar in relation to the bed-plate A, the walls of the chambered head F being provided with suitable guideways, to allow of the same.

The slide-bar Q, hereinbefore referred to as carrying the fulcrum of the lever-arm P, plays at one end through a guideway, *p*, of the chambered head F, and at the other end a screw-bolt, *q*, freely enters it. Said bolt *q* screws into and through one side of the chambered head, and exteriorly is provided with a milled head, for convenience in turning it. By this arrangement of parts the fulcrum of the lever on the slide-bar Q and the connection between such lever and the feed-bar are rendered adjustable in relation to the bearing of such lever against the edge of its cam H, and thus the length of the horizontal movement of the feed-bar, and consequently the feed of the material being sewed, can be regulated as desired.

The needle-bar carries the needle *r*, which is suitably attached thereto, and this needle, in its up-and-down movement, plays through the throat *s* of the cloth-plate R, making a part of the bed-plate. The foot-piece S of the upper feed-bar, N, is shaped to pass in its horizontal movement aforesaid to one side of the needle-throat—to wit, between such throat and the upright part of the standard B—and to the rear of the needle-throat in relation to the direction of feed of the goods through the machine, (shown by the arrow, Fig. 9,) and its bottom and acting face is preferably serrated or otherwise roughened.

The foot-piece T of the presser-bar M is shaped to pass to the left of both the foot-piece of the feed-bar and needle-throat *s* and to the front side of the latter, and it is suitably cut out for the foot-piece of the feed-bar and the needle to move under the action of their operating mechanism.

U is a horizontal shaft, placed below the bed-piece A with its axial line coincident with the vertical plane of the axial line of the driving-shaft. This lower shaft, U, is driven from the driving-shaft C by connecting mechanism consisting of an eccentric, V, fixed to the driving-shaft, and a strap, W, surrounding said eccentric. This eccentric strap W is a continuation of a connecting-rod, X, and intermediate of its length said rod carries a slide-block, *t*, on which it turns by a pivot-pin, *u*, said block being arranged to play within and along a vertical guide-groove, *v*, of the upright part to the standard B. The direction of this guide-groove is in a vertical plane coincident with the vertical plane of the axis of the two shafts. This rod of the eccentric-strap, at its lower end, has a stud-pin or friction-roll, *w*, which projects into a radial slot, *x*, of a vertical disk, Y, fastened to the lower shaft, U. The distance between the axis of the intermediate fulcrum-pin, *u*, of the connecting-rod X and the axis of the eccentric-strap W should be always exactly half of the distance between the axes of the two shafts C U, and the distance between the axis of the lower pin or stud, *w*, and the axis of the intermediate fulcrum-pin, *u*, should be always less than the distance between the axis of such fulcrum-pin *u* and the axis of the eccentric-strap W. This lower shaft, at its end opposite to that connected to the driving-shaft, as above described, carries a concentric circular disk, Z, which rotates with it, and in such rotation turns within a stationary concentric circular chamber, A^2, of the block B^2, fixed to the under side of the bed-piece, which chamber is the shuttle-race of the machine. The outer face of this disk Z has a fixed block, C^2, which occupies a portion of its surface, and is shaped to make a rest for the point *y* and heel *z* of a shuttle, D^2, of a crescent shape, and to leave an open space, a^2, intermediate of such rests of the shuttle against it and between it and the shuttle. This block C^2, together with its carrying-disk Z, is the shuttle-driver of the machine. The shuttle D^2 fits the inner periphery of the circular chamber or shuttle-race A^2, and it is carried around the same under the revolution of the lower shaft, U, and its shuttle-carrier C^2. The shuttle, between its point and heel, is chambered in its thickness, and in this chamber is a bobbin or spool of thread, b^2, turning upon a center post, c^2, of the shuttle, and the thread passes from this bobbin to and under a spring pressure-disk, d^2, of the shuttle, and thence to an eye, f^2, in the wall of the chamber of the shuttle, which eye is coincident with the axis of the lower shaft, and thus the shuttle-thread is delivered to the action of the needle, as will hereinafter appear, and through the pressure-disk d^2 the desired tension on the same is obtained.

The location of the shuttle and its rotation within and around its race, as above described, are such relative to the up-and-down movement

of the needle under the action of its bar L and mechanism connected therewith, as described, that its point, which is at the periphery of the shuttle-race, will pass above the eye of the needle and between the needle and its thread when the needle has slightly receded from its lowermost position, and thus formed a loop of the thread. The outer face of the block C^2, making a part of the shuttle-carrier, is situated in such relation to the up-and-down movement of the needle, as aforesaid, that as it rotates to carry the shuttle around it will pass to the right of the needle in its downward movement, and as the needle moves downward and passes the same it will be in such position relative thereto that in case the needle is out of its proper vertical line it will then bear against and press the same into position for the point of the shuttle to enter the loop of the shuttle-thread, and thus the needle is positively confined and held for such operation, should it in any way, by reason of its being bent or otherwise, be running in a line out of its proper path relative to the path of the point of the shuttle.

The open end E^2 of the shuttle-race A^2 is closed to prevent the escape of the shuttle from it in the rotation of the shuttle within it by two arms, F^2 G^2, one, F^2, of which acts as an under or auxiliary feed-bar, to be explained hereinafter. The other arm, G^2, swings upon a pin, g^2, and it has a spring-catch, h^2, which interlocks with a notch of the shuttle-race block B^2 when such arm is in its closed position over the open end of the shuttle-race, and on a release of this spring-catch h^2 this arm can be swung out of position for the removal of the shuttle from its race.

The under or auxiliary feed-bar, F^2, making also one of the closing-arms to the open end of the shuttle-race A^2, as above stated, is secured at its lower end to a horizontal rocker-shaft, H^2, which is arranged to rock in bearings of the under extension of the shuttle-race block B^2, and has a radial arm, I^2, which at its free end bears against the periphery or edge of the cam J^2 on the lower shaft. The upper end of this under or auxiliary feed-bar, at its working face, which preferably is serrated or otherwise roughened, lies within an opening, j^2, in the cloth-plate, and it may be either flush with or project slightly above said plate, and such working face is shaped to correspond to that of the working face of the upper feed-bar, as herein described. The under or auxiliary feed-bar swings forward and backward within given limits within this opening j^2 of the cloth-plate, which is of suitable shape and size therefor, and its forward movement is with and in consequence of the similar movement of the upper feed-bar, and its backward movement because of the action of the cam J^2 on the radial arm I^2 of its rocker-shaft H^2, as will hereinafter fully appear.

The outer face of the shuttle-carrier C^2 has a raised rib or projecting piece, k^2, the outer edge of which runs at an incline thereto, and it is otherwise so shaped and situated between the eye f^2 of the shuttle D^2, for the delivery of the shuttle-thread, and the periphery of the shuttle-race, and in such relation to said shuttle-eye, that under the rotation of the carrier it will in no manner interfere with the travel of the needle, and that as it passes around the shuttle-thread leading from the shuttle-eye to the needle-throat of the cloth-plate, in the making of each stitch, will begin to ride or pass upon it just previous to the entrance of the point of the shuttle between the needle and its thread or into the needle-loop, as herein described, and will continue to so ride upon and pass over it until such point of the shuttle has entered the needle-loop, when it will drop from the same to the outer face of the shuttle, and thus the shuttle-thread is placed out of or deflected from the line of movement of the shuttle-point at such time, and all possibility of interference between it and the point of the shuttle is prevented.

l^2 is a button or plate, which projects from the front or outer face of the disk Z, making a part of the shuttle-carrier, and is in position to lie against the inner face of the shuttle as it travels around within its race. The stem or shank m^2 of this button l^2 enters into and passes through the thickness of the said disk, and at its inner end it has a head-piece, n^2, which rests and bears against the inner face of the shuttle-race, and such shank to said button is of suitable length for the button to have a lateral play relative to the thickness of said disk. A portion of the said inner face of the shuttle-race, against which the said head n^2 to the button l^2 bears in the rotation of the shuttle-carrier, has a depression, o^2, of suitable shape for it to enter, and the remainder of such inner face along said line of bearing is flat and in a parallel plane with the vertical plane of rotation of the shuttle and its carrier. In the rotation of the shuttle and its carrier, as the head of this button travels over the flat portion of its bearing-face in the shuttle-race the button is pressed outwardly against the shuttle, which, in turn, is thereby pressed outwardly against the arms F^2 G^2, which close the open end of the shuttle-race, and as the said head travels over the depressed portion of its said bearing-face the outward pressure of the button upon and confinement of the shuttle, as aforesaid, is released, and the shuttle is thus left free to move laterally to a limited extent within its shuttle-race as it then rotates around and through the same.

The flat and depressed portions of the bearing-face for the button-head n^2 above described are situated in such relation to each other and to the movement of the shuttle through its race that the pressure upon and confinement of the shuttle against the arms which hold the shuttle against escape from its race will commence just previous to the entrance of the shuttle-point into the needle-loop in the making of a stitch, as herein described, and continue till such entrance is effected and for a short por-

tion of the rotation thereafter, but will certainly be released because of the backward play allowed to the button by the depression o^2 in time for the needle-thread to freely pass between the inner side of the shuttle and the contiguous face of the disk Z to the shuttle-carrier and its button l^2 in the continued rotation of the shuttle. This release of the pressure of the button against the shuttle continues until the shuttle is again about to enter a needle-loop, when it again occurs, and so continues, as before, and so on for each rotation of the shuttle. By these means the shuttle is brought and held positively in position relative to the needle-loop, when it is to take such loop, and afterward it is given sufficient freedom of lateral movement in its race to allow the loop of the needle-thread to pass freely about and around the shuttle as the shuttle continues to enter it, and similarly to pass freely between the shuttle and its race in its escape therefrom in the after completion of the stitch, by the drawing up of such loop in the running of the machine.

K^2 is the spool from which the needle is supplied with thread. This thread passes from its spool to and between a horizontal plate, p^2, and the periphery of a vertical wheel, q^2, arranged to turn within the bracket-arm B. The plate p^2 rests upon the wheel, and it is held in contact therewith by the pressure of a spiral spring, r^2, which surrounds a post, s^2, and is adapted by a screw-nut, t^2, to be adjusted as to its pressure upon the plate, and therefore as to the pressure of the plate upon the wheel. These parts constitute the tension device of the machine, and by arranging one of them to roll or turn as described there is no possibility of the thread being obstructed in its passage between them, while at the same time the desired restraint or tension on the thread will always be maintained. From the tension device the needle-thread passes to and through a stationary eye, w^2, and thence under a stationary hook, v^2, below such eye, which are upon the chambered head F of the standard B, to and through an eye, w^2, at the outer end of an arm, L^2, that is arranged to swing upon a pivot, x^2, at the right of said chambered head F, and to enter, by a stud or pin, y^2, into and engage with a peripheral cam-slot, z^2, of the driving-shaft C, and from thence to the eye of the needle, entering the same at the left-hand side thereof, Fig. 1. This arm acts as a take-up or controller of the needle-thread, and its said swing is in a vertical direction between the said stationary eye w^2 and hook v^2, and at its said point of suspension and connection with the cam-slot z^2 it is in frictional contact with a plate, M^2, attached by set-screw a^3 to the goose-neck standard B in proper position therefor. This thread take-up or controller, through the working of its operating-cam z^2, is given an upward-and-downward movement. This movement is such in relation to the downward travel of the needle that its downward movement begins after the needle commences to move downward, and so continues, even after the needle has begun to move upward, and so long as the shuttle in its rotation continues to draw the needle-thread downward through the eye of the needle and the cloth being sewed, when its upward movement commences and continues, ending just after the upward movement of the needle, when it rests, and again begins its downward movement after the needle has begun its downward movement, and so on, as before. This rest of said take-up or thread-controller, after its upward movement and of the similar movement of the needle, as aforesaid, holds the thread running from it to the eye of the needle under a suitable tension to insure the proper disposition of such thread by the needle, as the needle enters the cloth for the after-taking of the needle-thread by the point of the shuttle. These movements and rests of said thread take-up or controller are produced, as before stated, from the cam-groove z^2. This groove, in its part for giving the rest to said take-up arm, as aforesaid, is slightly widened as to the diameter of the stud-pin or friction-roll y^2 running in it, so as to allow to said take-up arm sufficient play in its said operating cam-slot z^2, by moving against its friction-holding plate M^2, for it to move downward, even before the part of the cam-groove which is shaped to produce such movement has come into operating position thereon, should there be any increased tension in the needle-thread on the downward travel of the needle because of any then increased thickness in the goods being sewed.

With the connection herein described between the driving and lower shafts, C U, as the axis of the eccentric V moves from its highest to its lowest vertical position relative to the axis of the driving-shaft, and in either direction of the turn of the eccentric, the axis of the stud w approaches the axis of rotation of the lower shaft, and as the axis of the eccentric moves from its lowest to its highest vertical position relative to the axis of the driving-shaft, and in either direction of the turn of the eccentric, the axis of said stud recedes or moves away from the axis of rotation of the lower shaft, and such radial distance is the greatest when the axes of the eccentric and of the stud are in their highest position, which is when they are in a vertical line coincident with the vertical line of the axes of the driving and lower shafts, and from such greatest radial distance the radial distance gradually diminishes, in whichever direction the eccentric is turned, until the axis of the stud reaches the horizontal plane of the axis of the lower shaft, when such axis of the stud is nearly at its shortest radial distance, and from that time it slightly decreases such relative radial distance in the continued rotation of the lower shaft until the axis of the stud reaches its lowermost position, when, as it moves upward to the horizontal plane of the axis of the lower shaft, it begins to slightly recede from the axis of the lower shaft, and thus to increase its radial distance therefrom, and it so continues until

the axis of the stud reaches its greatest radial distance aforesaid, when, on a continued rotation of the lower shaft, the axis of the stud again begins to approach the axis of such rotation, and so on, as before. Thus it is obvious that the axis of the stud, in passing through the part of its travel which is above the horizontal plane of the axis of rotation of the lower shaft, describes or passes through a circular line of greater length than in the part of its travel which is below the said horizontal plane; and, again, in said two parts of its travel the leverage upon the lower shaft is the longest in the first and the shortest in the second instance, causing in the second instance a quicker movement of rotation of the lower shaft about its axis of rotation than in the first instance, while the travel of the axis of the eccentric about the axis of rotation of the driving-shaft as to such part of rotation of the lower shaft is the same then as to all portions of it as it is in the other part of the rotation of the lower shaft. In this sewing-machine this action of the connection between the driving and the lower shafts, as above described, (by means of a suitable location of the shuttle and its carrier upon the lower shaft relative to the portion of the rotation of the lower shaft about its axis, which has the quickest movement, as aforesaid, and by means of the operation of the needle under the action of the driving-shaft and connecting mechanism, as aforesaid, relative to and across the plane of rotation of the shuttle,) is caused to impart an increased quickness of movement to the rotary travel of the shuttle from or about the time the point of the shuttle enters between the needle and its thread and begins to pull such needle-thread downward, and to thus draw and place it about and around the shuttle until the shuttle has reached the position in its travel when such loop of the needle-thread begins to escape from or leave the shuttle, all of which occupies one-half part, or thereabout, of the whole rotation of the shuttle. By this means the taking of the needle-thread by and its escape from the shuttle are hastened relative to the operation of the needle and of the thread take-up or controller L^2, and to other movements in connection with the making of the stitch, by the needle and shuttle threads, and thus the shuttle is made to perform its part in the making of the stitch in the quickest possible time, increasing the opportunity of the needle, the thread take-up or controller L^2, and the other portions of the stitch-making mechanism to complete the stitch, as well as leaving them to their own separate and combined operations in that regard for a greater portion of the revolution of the driving-shaft than they would have if a connection and an effect therefrom upon the rotation of the shuttle such as above described were not employed and obtained.

In the several movements above described the rod which connects the eccentric-strap W and moves by a stud or friction-roll, *w*, in and out of the radial slot *x* of the rotating disk of the lower shaft, slides by its block *t* up and down within the guide-groove *v* therefor. This slide-block *t* (see Fig. 3) is made in three parts. Two of these parts are cut out, as at a^4, to embrace opposite sides of the pivotal pin *u* of the eccentric-rod X, and one, b^4, by its outer edge, c^4, fits the wall of its way or groove *v*, and the other, d^4, at and along its outer edge, f^4, tapers or is of wedge shape from end to end, and there receives the remaining part g^4, which, along its edge h^4 in contact with the tapered edge f^4 of the part d^4, tapers also, or is of wedge shape in its length, and along its other edge, i^4, is straight to fit the wall of the slide-way or groove *v* for such block, and has a beaded set-screw, k^4, that passes through a slot, l^4, running lengthwise of it, and is countersunk therein, and so fastens it to its adjoining part. This construction of the slide-block *t* enables it to be adjusted to its bearing along the walls of its guideway or groove, to compensate for its wear and the wear of its said bearing, by simply unloosening the set-screw h^4, and then forcing the outer wedge part in the proper direction therefor, and afterward tightening up said screw, all as is obvious without further description.

The eye f^2 of the shuttle, at which the thread passes from the shuttle in the making of the stitch, and which, as before stated, is at the axis of rotation of the shuttle, is elongated from said axis and in the line of such rotation of the shuttle, but in the opposite direction thereto—that is, toward the heel of the shuttle. When, in the rotation of the shuttle, its point is passing into and through the needle-loop the shuttle-thread is passing out of the shuttle-eye at the axis of rotation of the shuttle, which is in line with one end of its elongated eye, and as the shuttle continues its rotation such thread works from such end toward and finally reaches the other end of the eye at or about the time the loop of the needle-thread is escaping from the shuttle, owing to the upward movement of the needle, and it is then drawn up with the loop of the needle-thread by the then upward movement of the take-up or controller of the needle-thread to complete the stitch. By these means, under the rotation of the shuttle, the shuttle-thread between the eye of the shuttle and the cloth being sewed at the time the needle-loop begins to draw off, as aforesaid, from the shuttle, has a length greater than the distance between the cloth being sewed and the end of the elongated shuttle-eye which is then uppermost and the nearer thereto, and this increase in length of the shuttle-thread over the distance then between such end of the shuttle-eye and the cloth being sewed equals in substance the length of the elongated eye from end to end—or, in other words, the distance which such end of the shuttle-eye is to the rear of that end of the shuttle-eye which is coincident or in line with the axis of rotation of the

shuttle. Thus the shuttle-thread is given a slack for the loop of the needle-thread to handle as it is drawn up by its take-up or thread-controller to complete the stitch, and consequently the needle-thread, of itself, at such time has no labor or strain upon it so far as the shuttle-thread is concerned, which obviously it would have were not the shuttle-eye so elongated and the necessary supply of the shuttle-thread been previously given out to the needle-loop, as has been described.

By the location of the shuttle-eye at the axis of rotation of the shuttle it obviously is always at the same distance from the cloth as it is sewed; and if not elongated, as has been herein described, the shuttle-thread passing through it to the cloth would at all times be taut, and when required to complete the stitch would have to be drawn off from the shuttle-bobbin against the tension device of the shuttle by the needle-thread itself as it is drawn up by its take-up and controller; also, the location of the shuttle-eye at the axis of rotation of the shuttle is important in itself, for if otherwise placed—that is, at either side of such axis—there would be no control of the shuttle-thread for perfect stitching, which obviously would make it impracticable; and while, with the shuttle-eye located at the axis of rotation of the shuttle, the shuttle-thread could be drawn off to advantage from its bobbin directly and only through the upward pull upon it of the needle-loop as it is drawn by its take-up or thread-controller, as described, still the elongation of the shuttle-eye which has been described is very essential, for the reasons which have been given, and for the further reason that it enables the requisite amount of slack in the shuttle-thread to be obtained at and only at the time it is needed. This operation upon the shuttle-thread, because of the axial and elongated shuttle-eye, secures a perfect lock-stitch, and thus an elastic seam.

The under auxiliary feed-bar, F^2, as before stated, works in one direction with the forward movement of the upper feed-bar, and in this manner the goods being sewed are griped between the two, and thus, under the action of the mechanism provided for operating the upper feed-bar, their feed of the goods is rendered most positive and sure. In this forward feed of the goods the under or auxiliary feed-bar is entirely free to move with the upper feed-bar and the goods, and the upper feed-bar has no resistance of any kind except the weight of the under or auxiliary feed-bar and the resistance incidental to the weight of the goods to overcome, all of which obviously is slight, and as the backward movement of the under feed-bar is by and through a revolving cam, J^2, such movement is obviously secured in a positive manner, and can be graduated as to its quickness as may be desired by suitably shaping the cam J^2 therefor. As to this feed of the goods by the upper and lower feed-bars, the operation thereof proceeds from the driving-shaft C and its cams G H through the connection between them and the upper feed-bar, and the arrangement of this mechanism is such relative to the mechanism for operating the presser-foot that when the upper feed-bar is griping the goods between it and the lower or auxiliary feed-bar (which preferably is arranged so as to then be in a line directly under the upper feed-bar) and is feeding them forward the presser-foot will be lifted from contact with or pressure upon the goods, and vice versa; and, again, this operation of the feed is arranged to occur in proper relation to the travel of the needle and other parts of the machine by which the stitch is formed, as is well known in all sewing-machines.

It is plain from this description that while three elements—to wit, an upper feed-bar, a presser-foot, and a needle—are all worked from a common driving-shaft, they are severally operated by mechanism from such shaft which acts in itself independently upon its respective parts, and the movement of any one is in no sense dependent upon the movement of either or both of the others.

Otherwise than has been herein particularly specified, the sewing-machine herein described works in all respects substantially similarly to other machines of a similar kind, and therefore it is not deemed necessary to herein particularly explain the same in such respects, as they are obvious to all conversant with the running and operation of sewing-machines.

I do not broadly claim a shuttle having an eye at the axis of rotation, as such, of itself, is not my invention.

Having thus described my invention, what I claim, and desire to secure by Letters Patent, is—

1. The combination, with the upper feed-bar, N, the cams G H, and driving-shaft C, of the U-shaped tumbler O, embracing the former cam, the lever P, and a spring, *m*, all constructed and arranged together to operate the feed-bar, substantially as and for the purpose described.

2. The combination, with the presser-bar M, the cam G, and driving-shaft C, of the U-shaped tumbler O, fulcrumed in the presser-bar and embracing the said cam, and a spring, *d*, all constructed and arranged together, substantially as and for the purpose specified.

3. The needle-bar L, the upper feed-bar, N, and presser-bar M, in combination with the needle-bar having the slotted cam *b*, cams G H, crank-arm K, driving-shaft C, tumbler O, lever-arm P, springs *d m*, severally constructed and arranged together and connected to the said several bars, all substantially as and for the purpose described.

4. The combination, with a continuous rotating shuttle-carrier and shuttle, of a block, *t*, in parts, as described, a guideway, *v*, on standard D, and a connecting-rod, X, having a fulcrum, *u*, on block *t*, hung to eccentric V, of a rotating shaft, C, and arranged to move

in a radial slot, *x*, of a rotating shaft, U, all substantially as and for the purpose described.

5. A continuously-rotary shuttle, D^2, having an elongated eye, f^2, one end of which eye is coincident with the axis of rotation of the shuttle and the other end is toward the heel of the shuttle, substantially as and for the purpose described.

6. A rotary carrier for a continuous rotary shuttle, D^2, provided with a raised rib or edge, k^2, having its outer edge inclined with respect to the shuttle-carrier, whereby the needle-thread, as it passes the same, will be deflected from the path of the shuttle-point, all substantially as and for the purpose described.

7. A continuous rotary shuttle, D^2, and its carrier C^2 and raceway A^2, in combination with the button l^2 and its head n^2, arranged in such raceway, and with the flat and depressed bearing-face *o* for such button-head, all substantially as and for the purpose specified.

8. An upper feed-bar, N, arranged to rise and lower and to be moved by mechanism forward and backward, in combination with an under or auxiliary feed-bar, F^2, arranged to gripe the material being sewed between it and the upper feed-bar, and to move forward and backward, receiving its forward movement directly from and because of the similar movement of the upper feed-bar, and its backward movement by and through mechanism acting upon it alone and independent of the operation of the mechanism of the upper feed-bar in a similar direction, all substantially as described.

9. An upper feed-bar, N, arranged to rise and lower and to be moved by mechanism forward and backward, in combination with an under or auxiliary feed-bar, F^2, arranged for the griping of the material being sewed between it and the upper feed-bar, and to move forward and backward, receiving its forward movement directly from and because of the pressure of the upper feed-bar upon it in the similar movement of the upper feed-bar, and its backward movement by and through a radial arm, I^2, secured to it, and a revolving cam, J^2, acting together upon it alone and independent of the operation of the mechanism of the upper feed-bar in a similar direction, all substantially as described.

10. The combination, with a rectilinear reciprocating needle, *r*, of a continuously-rotary shuttle-carrier, arranged to pass at one side of said needle and to press or bear by the face of its block C^2 against it should the needle be bent or otherwise placed out of its proper line of movement, all substantially as described.

11. The raceway A^2, having an open end for the continuous rotary shuttle and its carrier C^2, in combination with arms F^2 G^2, closing said open end, the arm F^2 being adapted to act as an under or auxiliary feed bar and the arm G^2 to be closed upon and opened from the said raceway, all substantially as and for the purpose described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

JOB A. DAVIS.

Witnesses:

EDWIN W. BROWN,

W. S. BELLOWS.